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| 10/042,342 | 01/11/2002 | Beng S. Ong | D/A1333 | 6897 |

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100 Clinton Ave. S.
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| EXAMINER | |
|---|---|
| KIELIN, ERIK J | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2813 | 5 |

DATE MAILED: 10/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

| Offic Action Summary | Applicati n No. | Applicant(s) |
|---|---|---|
| | 10/042,342 | ONG ET AL. |
| | Examiner | Art Unit |
| | Erik Kielin | 2813 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *24 July 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *6-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Pri rity under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election of the invention of group II, claims 6-34 in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Cancellation of non-elected claims 1-5 is acknowledged.

### *Information Disclosure Statement*

2. The information disclosure statement filed 11 January 2002 (Paper No. 2) fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because the copy of the article by **Garnier** et al. is completely illegible. A legible copy is respectfully requested. All other documents listed have been considered.

It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

*Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims **6**-11, 13, 14, and **16**-19, 22, 25-27 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,347,144 (**Garnier** et al.).

Regarding independent claim **6**, and claims 7 and 8, **Garnier** discloses a thin film transistor (TFT), comprising a substrate, gate electrode (called "conducting grid"), gate dielectric, and source/drain electrodes (col. 2, lines 20-29; col. 6, lines 19-47) and a semiconductor layer comprising a polythiophene derived from monomer segments shown in col. 4, line 35 to col. 5, line 21, labeled as formula "(III)", wherein the source/drain electrodes and gate dielectric layer contact said semiconductor polythiophene. Note that the "conducting grid" necessarily serves as the gate electrode; otherwise the transistor would be inoperable. **Garnier** discloses the polythiophene of formula (III) shown in col. 4, to have the following substituent groups:

> X and X' independently represent O, S, Se, Te, or --N(R)--,
>
> R represents H, alkyl, substituted alkyl, aryl, or substituted aryl;
>
> $R_1$, $R_2$, $R'_1$, $R'_2$, $R'_3$, and $R''_3$ each independently represent --H, Cl, F, or a --$CF_3$, --$NO_2$, --CN, --$COOR_3$ group, --$N(R_4)(R_5)$, alkyl, substituted alkyl, aryl, substituted aryl, alkoxy or polyalkoxy,
>
> $R_3$ represents an alkyl or substituted alkyl group or a metal,
>
> $R_4$ represents H or an alkyl or substituted alkyl group,
>
> $R_5$ represents an alkyl, acyl, or aryl group or $R_1$ and $R_2$ and/or $R'_1$ and $R'_2$ pairs together represent a divalent hydrocarbon

group which may be unsaturated or possibly interrupted and/or terminated by at least one heteroatom,

Y, $Y_1$, $Y_2$, and $Y_3$ independently represent the following groups: --C(R')=C(R")-- --C≡C-- --N(R')-- --N=N-- --C(R')=N-- --N=C(R')--, wherein R' and R" independently represent --H, alkyl, substituted alkyl, aryl, or substituted aryl,

a, b, a', b' are numbers equal to 0 or 1, **or $Y_1$ may also represent a cyclic or heterocyclic arylene group**, and in this case b=1 and a'=0,

s and t are whole numbers, including zero, of which at least one is different from zero,

m' is a whole number equal to at least 1, the numbers s, t, and m' are such that

m' (s+t)=m,

m being a whole number between 4 and 24.

In the oligomer with formula III, units A and A' can alternate regularly or not. In addition, in a given oligomer, the substituents and/or heteroatoms of the units can be different.

In the instant case, units A and A' in **Garnier** are the equivalent of the instantly claimed units (I) and (II). Similarly, the units $R_1$, $R_2$, $R'_1$, $R'_2$, in **Garnier** are equivalent to the instantly claimed sidechains A and B. Any of Y to $Y_3$ in **Garnier** corresponds to D of the instant claims. **Garnier** also discloses that the units A and A' may be zero or any whole number which anticipates the instantly claimed 1-10 of (I) and 0-5 of (II). Note that only one of the subscripted Y's or Y is required since a, a', b, and b' may be zero.

Regarding independent claim **16**, and claims 17-19, **Garnier** discloses a TFT, as noted above, wherein Applicant's formula (III) is disclosed because subscript b may equal zero, which reduces the structure to two monomeric thiophene units in the oligomeric unit, wherein the A sidechains of each polythiophene monomer of instant claim **16** corresponds to the **Garnier**

formula (III) wherein $R_1$ and $R'_2$ are hydrogen and $R_2$ and $R'_1$ are alkyl groups. The monomer D is, as noted above, anticipated by **Garnier**.

Regarding claims 7-10, and 17-19, although irrelevant since D may be equal to 0, in addition to that indicated above, Y (the instantly claimed D) may be may be cyclic or heterocyclic arylene which anticipates the Markush group of D in the instant claims. And A and B of the instant claims corresponds to the **Garnier** $R_1$, $R'_1$, $R'_2$, and $R_2$ which may be, *inter alia*, alkyl or hydrogen.

Regarding claim 11, gold source/drain electrodes are disclosed (col. 8, lines 17-18), the gate electrode (called "metal grid") may be a metal such as gold (col. 6, lines 67-68), semiconductor, or conducting organic polymer (col. 6, lines 20-27), the gate dielectric (called "insulating layer") may be, *inter alia*, silicon dioxide ($SiO_2$) or an insulating polymer, such as polymethylmethacrylate (cols. 7-8, Tables I - III).

Regarding claims 13 and 14, method limitations do not have patentable weight in device claims. Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi* et al, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or

not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

Regarding claim 22, the instantly claimed n corresponds to m' in **Garnier**, which may be 4 to 24, which overlaps 5 to 5,000.

Regarding claims 25-27, the A and D units are as indicated above and are anticipated. Note that D may be zero in accordance with Applicant's claims.

### *Claim Rejections - 35 USC § 103*

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 12-15, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US Patent Application 2002/0053320 A1 (**Duthaler** et al.).

**Garnier** does not specifically indicate the claimed polymers for the gate dielectric (instant claim 12) or the plastic for the substrate (instant claim 15), but as noted above, discloses polymer insulating layers, PMMA being very similar to PMA (polymethacrylate).

**Duthaler** teaches a TFT and method of forming said TFT having the substrate, gate and source/drain electrode, and gate dielectric materials of instant claims 12, 15, 32, and 33, as well as the methods for depositing these semiconductor device features in instant claims 13 and 14 (albeit not having patentable weight). (See paragraphs [0034] through [0038], [0061], and [0078].)

At the time of the invention, it would have been obvious for one of ordinary skill in the art to use any of the plastics instantly claimed depending upon the desired properties. Selection of a known material based on its suitability for its intended use is *prima facie* obvious. See *In re LESHIN*, 125 USPQ 416 (CCPA 1960) ("Mere selection of known plastics to make container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious; and in view of 35 U.S.C. 103 it is a wonder that the point is even mentioned.")

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the materials for each of the semiconductor device features, and the methods of **Duthaler** to make the transistor of **Garnier**, to enable the extremely facile production of TFTs using ink jet printing.

7. Claims 20, 21, and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US 6,320,200 B1 (**Reed** et al.)

Regarding claims 20 and 21, **Garnier** does not specifically include the third monomeric unit having the B sidechain which is required to be present.

**Reed** teaches polythiophenes for electrical applications as shown the formulas in cols. 29-32 and teaches the instantly claimed central thiophene monomers in the oligomer having an even number (formula 27) or odd number (formula 23) of the B side chain, wherein B is hydrogen. The substitution of the alkyl (the A sidechains) is also shown to match that of the instant invention, as shown in formula (III) of the instant claims, and is also anticipated by

**Garnier**, as noted above since $R_1$, $R_2$, $R'_1$, and $R'_2$, may be independently varied as at least alkyl and hydrogen, as noted above.

It would have been obvious for one of ordinary skill in the art, at the time of the invention to provide central monomers in the oligothiophene having the hydrogen (B sidechain) in the central portion of the **Garnier** oligomer, in order to provide further control of the conductivity and properties the channel region of the TFT.

Regarding claims 28-31, the claims are obvious variations of the teaching of **Garnier** in view of **Reed**. Note that the benzyl linkage (monomer D) is anticipated by **Garnier** who teaches that the Y (equal to Applicant's instantly claimed D) is arylene, of which benzene is the most basic and commonly known unit.

8. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US 5,069,823 (**Sato** et al.).

The prior art of **Garnier**, as explained above, discloses each of the claimed features except for the number and weight average molecular weight ranges of the polythiophene.

**Sato** teaches the production of electrically conductive polythiophenes such as those disclosed by the general formula (III) in **Garnier**, wherein the weight average molecular weight is between 60,000 and 100,000 which overlaps the instantly claimed ranges (See Abstract; col. 1, lines 19-33.) Because of the relationship between the number and weight average molecular weights, it is held, absent evidence to the contrary, that the number average molecular weight inherently overlaps those instantly claimed in claims 23 and 24 because of the **Sato** weight average molecular weights. (See MPEP 2112.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the molecular weight for the polythiophene of **Garnier** as that taught in **Sato** as a matter of routine optimization. (See MPEP 2144.05.)

9. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US 6,232,157 B1 (**Dodabalapur** et al.).

**Garnier** discloses that the thickness of the gate dielectric (called "insulating layer") is 0.5 to 10 μm and the thickness of the polythiophene (semiconductor) may be 20 to 200 nm (col. 6, lines 48-54) which overlaps that instantly claimed. **Garnier** also teaches the thickness for the source/drain electrodes of 25 nm (col. 7, lines 27-30) which is near than instantly claimed.

**Garnier** does not teach the thickness of the substrate to be 10 μm to 10 millimeters.

**Dodabalapur** teaches a TFT and method for forming having polythiophene as the semiconductor channel wherein the substrate is made from plastic and is 30 to 100 μm, which overlaps that instantly claimed (col. 7, lines 9-11).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the substrate thickness of **Dodabalapur** as the substrate thickness in **Garnier**, because **Garnier** is silent to the thickness of the plastic substrate such that one of ordinary skill would be motivated to use conveniently known thicknesses which are readily available and already used for TFTs such as those in **Dodabalapur**.

Although the source/drain electrode thickness is not exactly as claimed, it would be an obvious matter of routine optimization to use the instantly claimed range because it has been held that claimed ranges of a result effective variable, which do *not* overlap the prior art ranges,

are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. See *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996). In the instant case, **Garnier** is not limited to the exemplary thickness and Applicant has provided no evidence to indicate that there exists anything critical to the thickness range presently indicated. It would have been obvious for one of ordinary skill in the art, at the time of the invention to optimize the thickness of the source/drain electrodes for a particular dimension TFT.

***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,445,1226 B1 (**Arai** et al.; col. 10, line 50) and US 6,242,561 B1 (**Mohwald** et al.; col. 5, lines 10-30) each teach polythiophenes which anticipate at least independent claims 1 and 16.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin

September 27, 2002